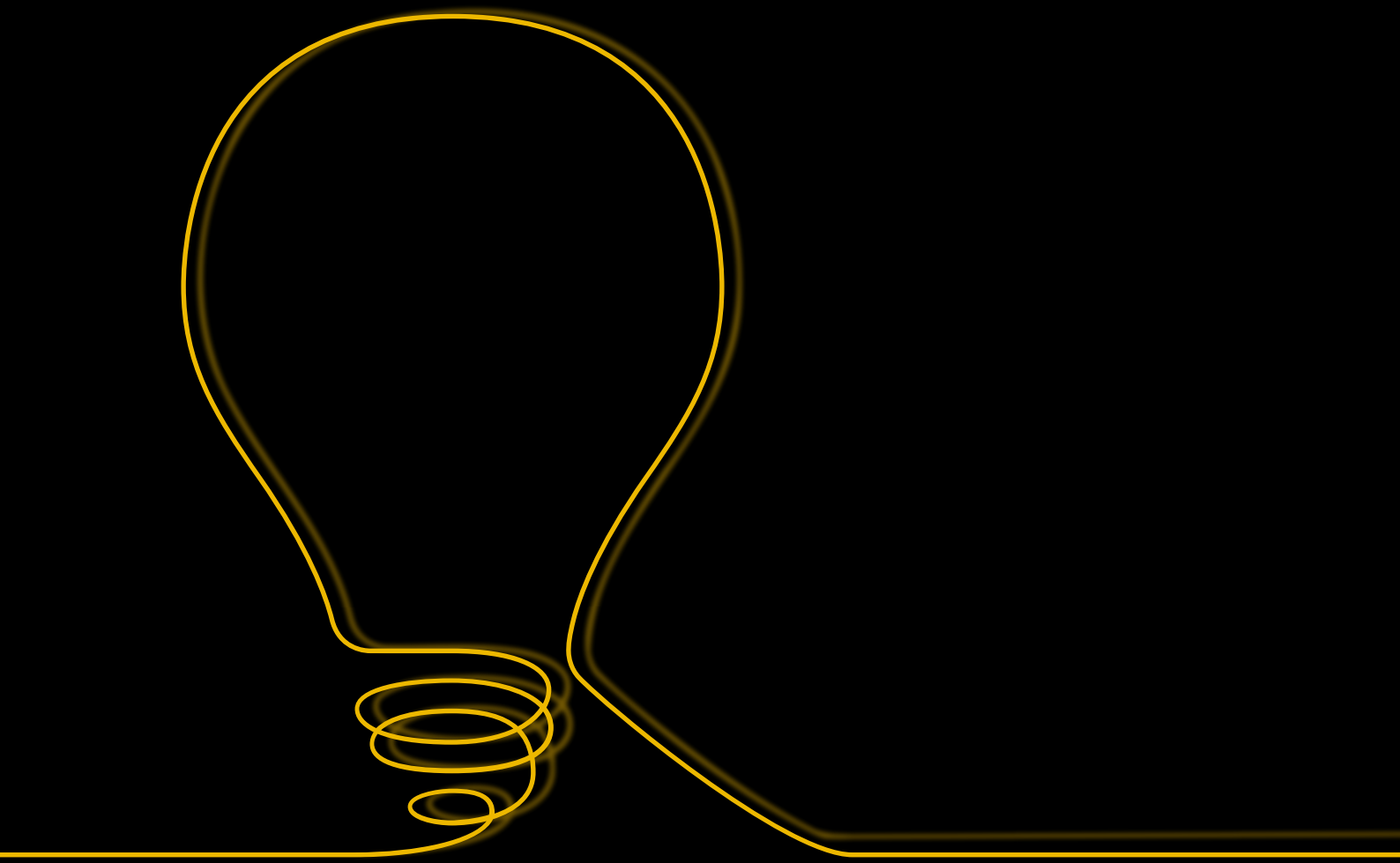


Business Awards

2020

iop.org

IOP Institute of Physics

Foreword

Physicists working in industry and business are key to the research and development of products and technologies. Many of the technological advances, inventions and innovations that make our lives easier and more secure have physics at their core.

The success of physics-based businesses is vital to our economy and to society, and the Institute of Physics (IOP) plays a vital role in bringing together physicists working in business and industry in global corporations, local companies and start-ups in the UK and Ireland.

The IOP's role is to foster, support and connect physicists working in industry and to enable physics-based businesses to thrive by recognising their achievements, supporting their efforts and allowing entrepreneurs and innovators to connect, share and learn.

The IOP Business Awards go from strength to strength with a record number of entries, and the industries recognised this year include electric vehicles, defence, environmental, healthcare, quantum sensing and computing. We are committed to developing strong, effective relationships with the winners and opening new opportunities with them through our Business Innovation and Growth network.

The key to solving many of today's environmental problems lies in advanced technology solutions and we are delighted to see so many of the award-winning companies focused on environmentally friendly solutions to current problems.

It is also especially rewarding to see the first of the Lee Lucas award winners, following the very generous donation by Mike Lee and Ann Lee (nee Lucas) which funds a cash prize, for very early stage companies taking innovative products into the medical and healthcare sector. Medical physics delivers the tools to tackle emerging health care challenges such as the recent Covid-19 pandemic.

I'd like to congratulate all of the 2020 IOP Business Award winners and thank the Business Awards judging panel for their expertise and continued support.

Thank you

Dr James McKenzie FInstP
IOP Vice-president for Business
(October 2016 - September 2020)

Background

The Institute of Physics (IOP) is the professional body and learned society for physics in the UK and Ireland, we seek to raise public awareness and understanding of physics and support the development of a diverse and inclusive physics community. As a charity, we're here to ensure that physics delivers on its exceptional potential to benefit society.

The IOP strategy, Unlocking the Future, sets out the part physics can play in helping to solve some of our most pressing global challenges such as an ageing population, the need to decarbonise our economies and ensure the security of food, water and energy supplies. To meet these challenges, we need to build a thriving, diverse physics community; unlock the capability required to realise the benefits of a new industrial era – and ensure the public are able and inspired to play their part in the debate.

IOP members come from across the physics community, whether in industry, academia, the classroom, technician roles or in training programmes as an apprentice or a student. However, IOP's reach goes well beyond our membership to all who have an interest in physics and the contribution it makes to our culture, our society and the economy.

We are a world-leading science publisher and we are proud to be a trusted and valued voice for the physics community.

A message from IOP's president

The IOP Business Awards recognise large and small companies that have built success on the creative application of physics. I'm delighted to be able to mark the amazing achievements of this year's award winners and to celebrate with you all.

As businesses and industries across the world continue to navigate their way through COVID-19, it's never been more important to showcase the incredible contributions physics-based businesses across the UK and Ireland have made towards the advancement of technology applied across a broad range of sectors such as healthcare, energy, defence and transport.

Jonathan Flint, CBE
President of the IOP

Business Innovation Award 2020

Awarded to small, medium and large companies that have excelled in innovation and delivered significant economic and / or societal impact through the application of physics.

Winners

- Advanced Hall Sensors
- Hirst Magnetic Instruments
- Promethean Particles
- Thornton Tomasetti Defence

Lee Lucas Award 2020

The Lee Lucas Award recognises and celebrates very early stage companies taking innovative products into the medical and healthcare sector.

Winners

- Cellular Highways
- Nebu~Flow

Business Start-up Award 2020

Awarded to businesses that have been incorporated for less than five years with a great business idea founded on a physics invention, with a great growth potential and/or the potential of significant societal impact.

Winners

- FeTu
- Geoptic
- ORCA Computing
- Oxford HighQ
- OxMet Technologies
- Photon Force
- QLM Technology

Quotes

Advanced Hall Sensors

"It's an honour to have been recognised by the IOP for our advances in the field of magnetic sensing and imaging, and to highlight the contribution of fundamental Compound Semiconductor physics to the success of the company"

Professor Mohamed Missous, CEO

Hirst Magnetic Instruments

"Magnetic technology is an important but obscure science, and the IOP award will certainly help us to introduce a strategic technology to new audiences and markets."

John Dudding, Managing Director

Promethean Particles

"Promethean Particles is thrilled to receive this business award. Innovation is in our DNA as we continue to work with clients around the world to develop new materials and new applications of nanotechnology."

Ed Lester, Interim CEO

Thornton Tomasetti Defence

"We are thrilled to receive this award from the Institute of Physics. JASSO represents our firm at its best, and highlights our ability to creatively apply science, engineering and technology to help our clients address some of the most complex problems we are currently facing."

Peter DiMaggio, Co-CEO

Nebu~Flow

"The Lee Lucas Award from the Institute of Physics is a great recognition for the company, and will enable us to access the IOP's support network to develop our business and deliver strong economic and social impacts in the treatment of both infectious and non-communicable diseases of the lungs."

Dr Elijah Nazarzadeh, CSO

Cellular Highways

"Our company is built on physics and led by physicists. And we believe our physical invention is really needed to advance our industry. Therefore it means a great deal to us to be recognised by the IOP. The prestige of this award feels great to the team and should also make us more attractive to job candidates, customers and investors."

Dr Samson Rogers, Co-Founder and CEO

FeTu

"It is an honour to be recognised by the IOP, an award that brings immense credibility to FeTu, the technology and business."

Jonathan Fenton, CEO and Founder

Geoptic

"The recognition of the Geoptic team's hard work by this IOP award is fantastic and sets us up well for success in future years."

Chris Steer, CEO

ORCA Computing

"ORCA Computing are very happy to receive this business start-up award for our optical-fibre based approach to quantum computing. By leveraging our proprietary quantum memory technology, ORCA is looking deliver the world's most scalable universal quantum computer, and that journey is greatly helped by support from institutions such as the IOP."

Richard Murray, Co-founder and CEO

Oxford HighQ

"The work we are doing at Oxford HighQ to revolutionise nanoparticle characterisation using optical microcavities is exciting and rewarding and to be recognised by the IOP, a world renowned and trusted voice in the physics community, is hugely satisfying for our dedicated team."

Mark Vosloo, CEO

OxMet Technologies

"Everything we do in every bit of our business rests on the foundations provided by physics, and we're delighted that the judges believe we have made a contribution to the field."

Michael Holmes, CEO

Photon Force

"I'm delighted with the IOP's recognition of the Photon Force team's innovative, physics-based work, developing ultra-fast time-resolved SPAD camera technology."

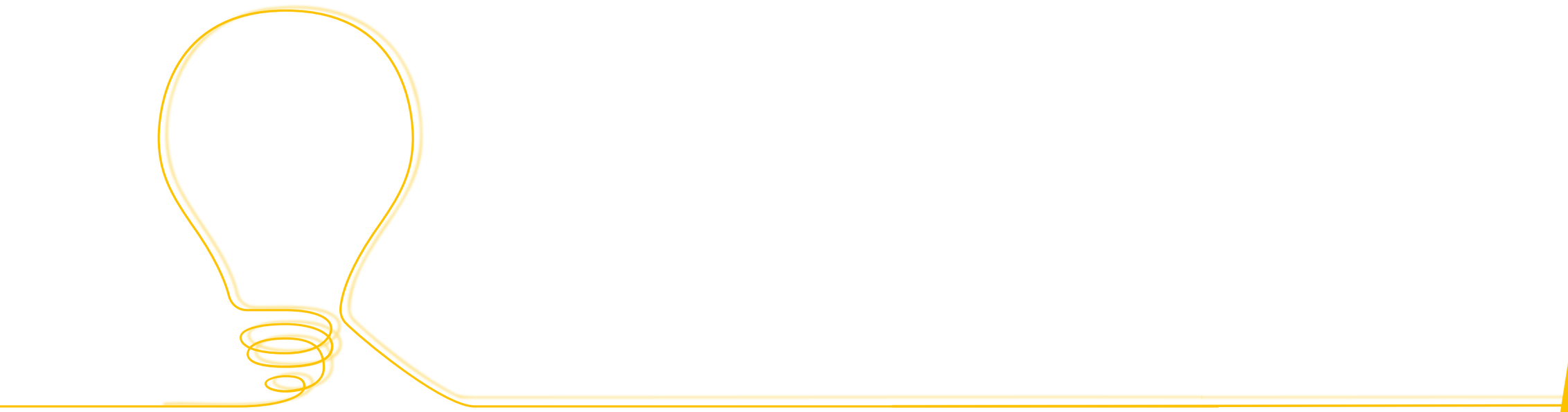
Richard Walker, CEO

QLM Technology

"We very much appreciate IOP's recognition of QLM's plans to industrialize UK quantum technology."

Murray Reed, CEO

Business Innovation Award



Business Innovation Award

Advanced Hall Sensors

The Company

Advanced Hall Sensors specialises in the design and manufacture of semiconductor Quantum Well Hall Effect (QWHE) magnetic sensors. It supplies to a global customer base in Industrial, Medical, and Oil and Gas industries, servicing demanding environments ranging from extremes of temperatures to very high sensitivity applications.

Advanced Hall Sensors has developed and commercialised a highly novel compound semiconductor magnetic sensor based on the Quantum Well Hall Effect (QWHE). The Quantum nature of the design and materials structure delivers huge gains in dynamic range, sensitivity and temperature stability over competing sensor technology.

The device has already unlocked an unrivalled sensing performance which is displacing traditional Silicon Hall sensors in high end applications such as fine pitch metrology and high sensitivity current sensing, with over 10 million discrete QWHE sensors sold in multiple global markets over the last 5 years.

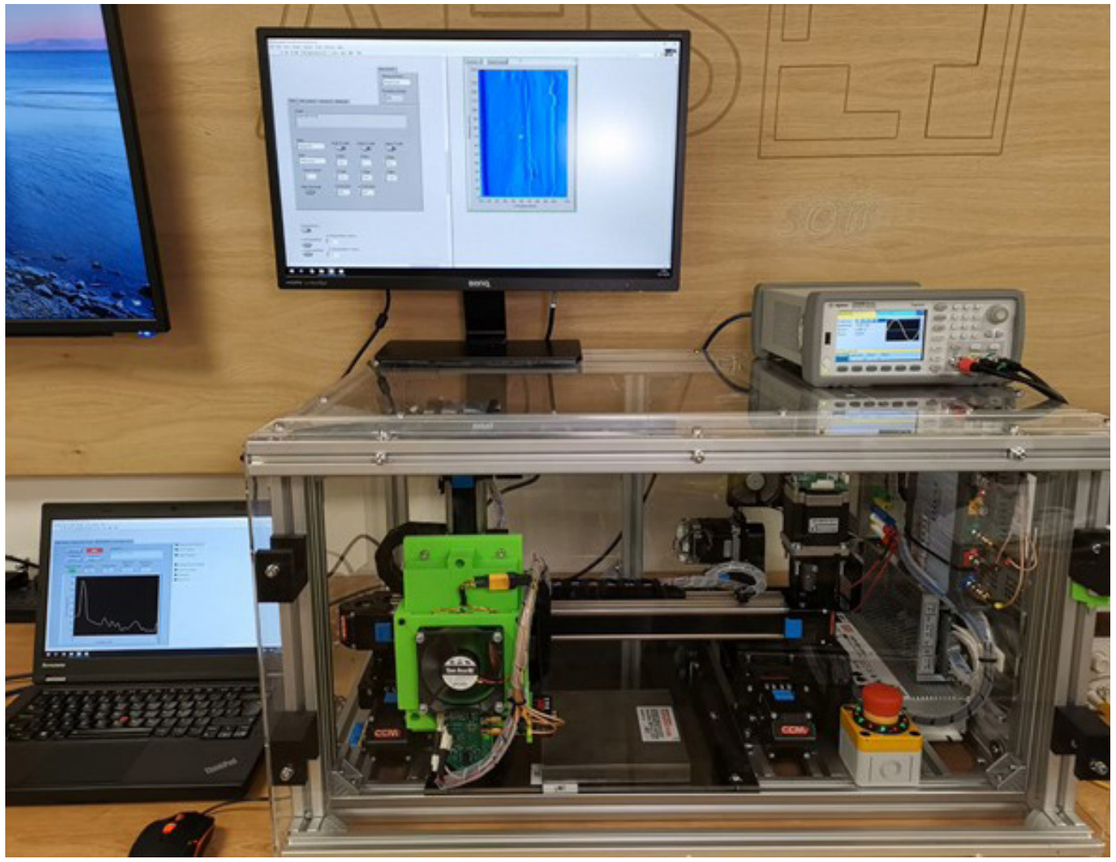
The company is now undertaking specialist system development to produce unique solutions underpinned by the performance and Intellectual Property embedded in the chip-scale QWHE sensor.

Examples include:

- Development of a hand-held Magnetic Camera as a cost effective solution for rapid personal security screening with 2D imaging and threat discrimination capability;
- Realisation of a rapid-scan, non-destructive test solution for identifying mm-scale, sub-surface defects in metallic components;
- An ultra-high resolution magnetic imaging system using a monolithic QWHE sensor array which has demonstrated micron scale imaging of microstructures such as domain wall boundaries in high-value materials such as electrosteels.

Impact

Enabled cost-effective, accessible nano Tesa scale magenetometry, generating many new real-world applications.



For pioneering work in the commercialisation of novel, ultra-high sensitivity compound semiconductor magnetic sensor products.

Business Innovation Award

Hirst Magnetic Instruments

The Company

Hirst Magnetic Instruments is a research-led magnetics company with a history of developing ground-breaking technical solutions, which address strategic technology sectors. The Hirst team design and manufacture three product streams: Magnet and Magnet Material Characterisation equipment, Magnetisers, and Gaussmeters (used for accurate magnetic field measurements in laboratory or industrial environments).

Hirst designs and manufactures state-of-the-art magnet and magnet material characterisation systems to meet customer requirements at the materials and finished industrially shaped magnet level. These PFMs operate on an open loop magnetic circuit and can fully characterise magnetic materials in seconds. Hirst has now developed a significant advance of the PFM process with mathematical support from the University of Exeter. These new PFM Self Demagnetisation Field Function (SDFF) units allow closed-circuit magnetic measurements to be made in open-circuit circumstances, something which has not hitherto been possible. This is an essential step needed for the characterisation of actual production magnets prior to assembly and magnetisation. This is an industry first and solves a high value industrial market challenge.

This technology extends the PFM open loop process, allowing closed-loop measurements to be made by using a proprietary new field interpretation model operating on a proven technology platform. This enables a high yield volume PM motor manufacturing supply chain and QA operations worldwide. This SDFF technology is the subject of the Innovation Award, with its high potential impact on magnetics in green energy technologies.

Impact

The SDFF technique can be applied to all “open” magnet characterisation techniques, in the laboratory or factory, where it can offer potentially 100% yields by ensuring that every magnet in the assembly has the same, specified characteristics required by the application. Essentially this advance enables a high yield volume manufacturing of permanent magnet-based products, ahead of other techniques.

For developing innovative magnetics technology and taking scientific processes into industrial production areas involving magnetizing and the accurate characterisation of magnetic components, promising significant increases in product yield in the manufacture of EV motors and making an important contribution to the green energy sector.

Business Innovation Award

PrometheanParticles

Formulating solutions with nanomaterials

Promethean Particles

The Company

Promethean Particles design, develop and manufacture nanoparticle dispersions to meet product specifications. We cover many industry needs such as inks and pigments, functional nanoceramics, biocompatible materials, printed electronics, and metal organic frameworks. We offer a feasibility service to tailor a custom made solution for the specific requirements of a customer.

Promethean Particles has succeeded, in collaboration with the University of Nottingham, in solving one of the greatest engineering challenges facing continuous hydrothermal synthesis, namely around the physical mixing of supercritical fluids. They have gone on to design, build and operate the world's largest multi-material continuous hydrothermal plant. The plant is now operated commercially and is capable of making high quality nanomaterials including metals, metal oxides, hydroxides and sulphides, as well as more complex nanoporous materials including LDHs and MOFs.

Continuous hydrothermal synthesis has been proven to be a flexible, economic and environmentally sustainable technology with the capacity to scale up, well beyond lab scale to full industrial scale production.

As an example of impact in the materials sector, Promethean has expanded the portfolio of materials significantly since the end of the SHYMAN project and now sells nanomaterials online via its e-commerce page.

Promethean has become the largest manufacturer of metal organic frameworks in the world. Metal Organic Frameworks are examples of materials that are now accessible on a multi-ton scale, as a result of the SHYMAN project. scale up trials or pilot scale studies with MOFs were traditionally hampered by the cost of the materials, leading to a stagnation in development through lack of affordability. Promethean now sells these materials at more than 10x lower prices than some of its competitors.

Impact

We can now make the world's most sophisticated nanomaterials 100x times cheaper than competitors, using a sustainable and versatile platform technology.

For solving the key fluid mechanics problem that held back the use of supercritical fluids in the production of nanomaterials, and now operating the world's largest facility, based in the UK.

Business Innovation Award

Thornton Tomasetti

Thornton Tomasetti Defence

The Company

Thornton Tomasetti Defence are a multidisciplinary firm of consulting engineers who provide expert advice on structural survivability, blast, ballistics and weapons effects to the UK Ministry of Defence, other UK Government Departments, the US, Netherlands, German, French and Canadian Navies as well as global defence companies and suppliers.

Understanding the ability of modern warships and their weapon systems to withstand underwater weapon attack is a key feature of their design. The testing of ships and equipments against underwater shock is fundamental to that understanding, and whilst the techniques for testing ship structures, equipments and systems is well understood and regularly practiced the same is not true for weapons and munitions. Whilst the theory is essentially the same as for normal ships equipment, the potentially explosive consequence of a failed test means that testing of live weapons has been restricted to only a very small number of types, and then only in extremely expensive bespoke test environments. This means that the understanding of response to shock is a significant unknown for the vast majority of weapon types. This is not only an issue for the United Kingdom, but also across the world.

Recognising the need for an alternative type of test, Thornton Tomasetti has developed a highly innovative, patented alternative system of shock testing live munitions based on a deep understanding and application of physics principles coupled with a thorough understanding of the engineering requirement.

The development of the JASSO airgun-driven shock test machine is revolutionising the conduct of live muniton tests by delivering an essentially disposable shock test machine, which replicates the shock environment experienced by a ship and its weapons following an underwater explosion from a torpedo or mine. The availability of this machine means that the shock performance and hence combat safety of the UK's inventory of maritime weapons, and other munitions embarked in warships and auxiliaries, can be determined and understood in a cost-effective and safe manner.

Impact

The development of the JASSO, portable, airgun driven concept has revolutionised live munitions testing in the UK, which will significantly improve combat safety of Royal Navy warships and sailors.

For the development of an innovative shock testing machine, which is revolutionising UK capability in the field of munitions and equipment survivability for the Royal Navy.

Lee Lucas
Award

Lee Lucas Award

Cellular Highways

The Company

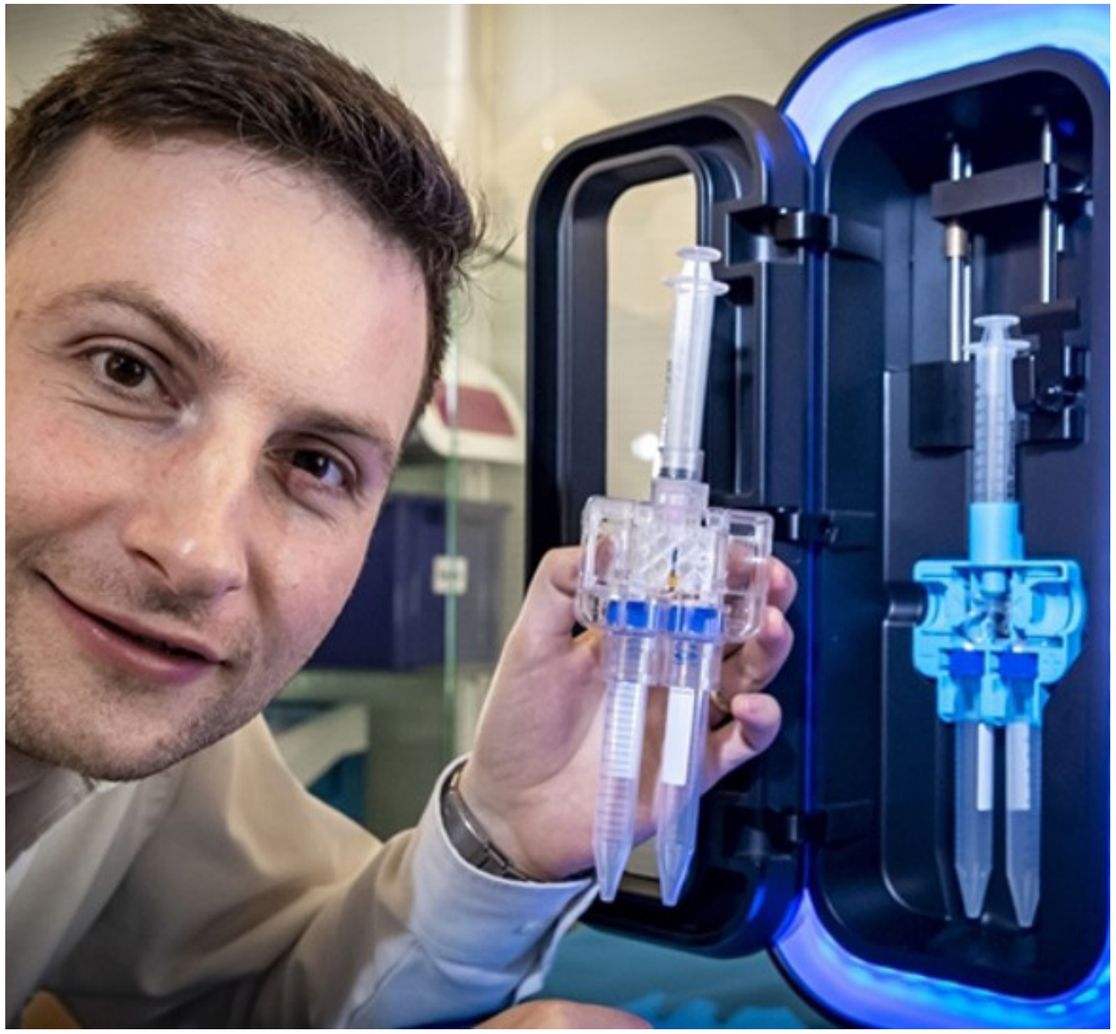
Cellular Highways develops and commercialises cell sorting instrumentation based on a novel technology, VACS (vortex-actuated cell sorting), which exploits new physical principles in inertial microfluidics. The technology will vastly increase the speed and scalability of sterile cell sorting, opening up new applications in cell therapy and other areas of biotechnology.

Cellular Highways has invented a new technology for cell sorting, based on recently discovered physical principles in inertial microfluidics. The technology, known as VACS (vortex-actuated cell sorting), works by generating a transient vortex within a microfluidic channel; this vortex flows downstream with a cell to be sorted, thereby gently deflecting it across the streamlines. Each deflection event has a time envelope of 23 microseconds, making VACS the fastest chip-based cell sorter yet invented.

Uniquely, VACS has the potential to achieve fast, scalable and sterile cell sorting for therapeutic, diagnostic and life science research applications. To this end, Cellular Highways has also built and demonstrated the viability of a cell sorter based on a 16x parallel VACS chip. This is now the fastest cell sorter in the world.

Scalable, sterile cell sorting has been a well-known need in cell therapy and regenerative medicine for decades but has been unattainable due to associated technological challenges. Promising cellular therapies for cancer and autoimmune diseases require the isolation of rare cell types and better control over the therapeutic product than is possible with incumbent technologies. These include therapies based on CAR-T cells, tumour-infiltrating lymphocytes, regulatory T cells, natural killer cells and stem cells, which often require sorting in batches larger than one billion cells based on multiple molecular markers. Adequate commercial equipment to satisfy this need does not presently exist. Other life science applications include single-cell diagnostics, phenotypic screening, and biosafe sorting, including virus and vaccine research.

A prototype of Cellular Highways' first commercial instrument, Highway1, is currently being evaluated by a number of cell therapy companies and research groups.



For the invention of a cell sorter based on the physics of inertial microfluidics, and the pioneering development of new tools for cell therapy based on this device.

Lee Lucas Award

Nebu~flow

Nebu~Flow

The Company

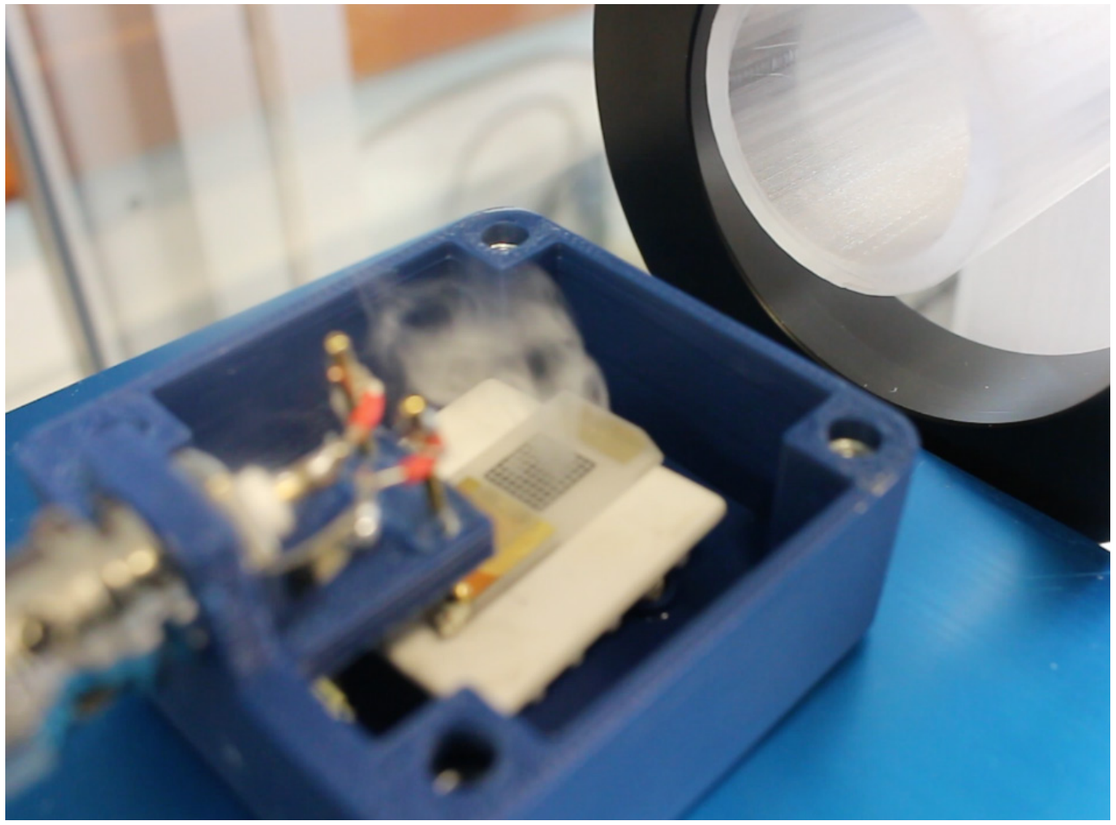
Nebu~Flow's acoustic aerosol formation technology enables delivery of hard-to-nebulise respiratory drugs to the lungs, including both existing formulations and emerging novel high-value therapeutics such as biologics, nanomedicines and vaccines.

Nebu~Flow is a spinout from University of Glasgow, developing an aerosol platform technology with primary applications in pulmonary drug delivery, but also in ventilator humidification, mass spectrometry, and spray-drying.

Respiratory diseases, such as asthma and cystic fibrosis, are usually treated by the inhalation of aerosols, where the effective delivery of medication is crucially dependent upon the droplet size to be between 1 and 5 micrometers. Larger droplets are caught in the upper respiratory tract, while smaller ones are exhaled before they can be adsorbed – neither reach the patient.

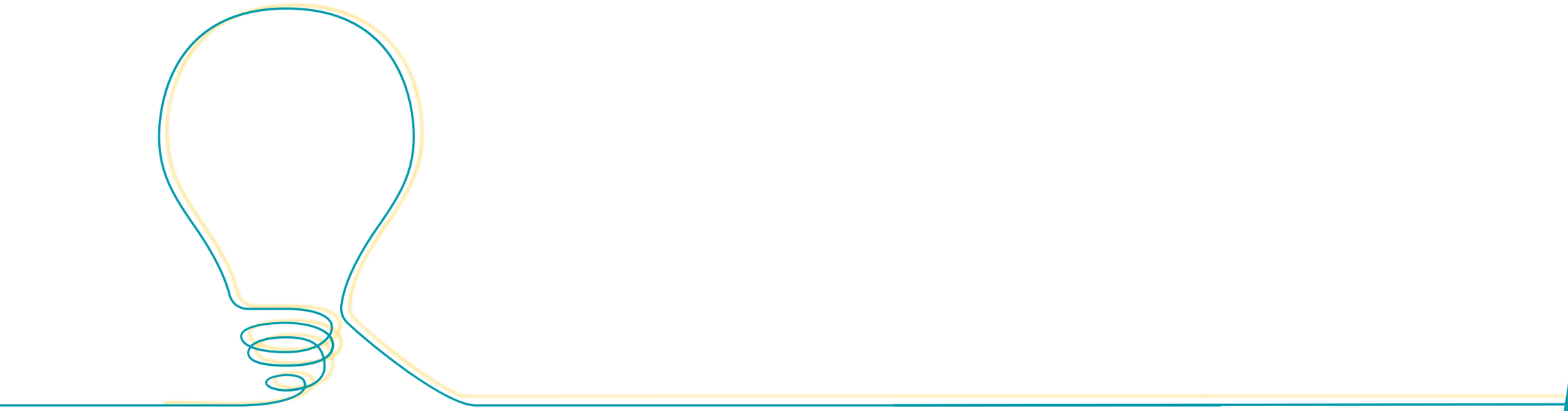
The Nebu~Flow technology is based on the control of the mechanical energy carried by acoustic waves, to disperse liquids in form of aerosols. It provides a unique control on the aerosol droplet size within the clinically effective range for efficient respiratory drug delivery. The technology is able to nebulise a much wider range of therapeutics than existing techniques, including existing drugs (i.e. suspension) and emerging "high-value" biologics and nanomedicines, which will be critically important in new treatments, currently unavailable to patients.

Nebu~Flow aims to partner with pharmaceutical and medical device companies to develop drug/device combinations and enable the delivery of currently limited formulations, critical in new therapies (e.g. for lung hypertension and cystic fibrosis).



For their exceptional efforts in developing and commercialising a new generation of acoustic nebuliser technology, enabling new treatment for lung disease to be delivered efficiently and improving the lives of millions of sufferers.

Business Start-Up Award



Business Start-Up Award

fetu
ROTICULATE

FeTu

The Company

Established in 2016, FeTu are an innovation driven enterprise based in West Yorkshire, that have created a revolutionary ‘green’ energy device targeting carbon reduction across a broad range of systems and industries. FeTu offers a disruptive enabling technology; a versatile ‘positive displacement turbine’ suitable for various applications.

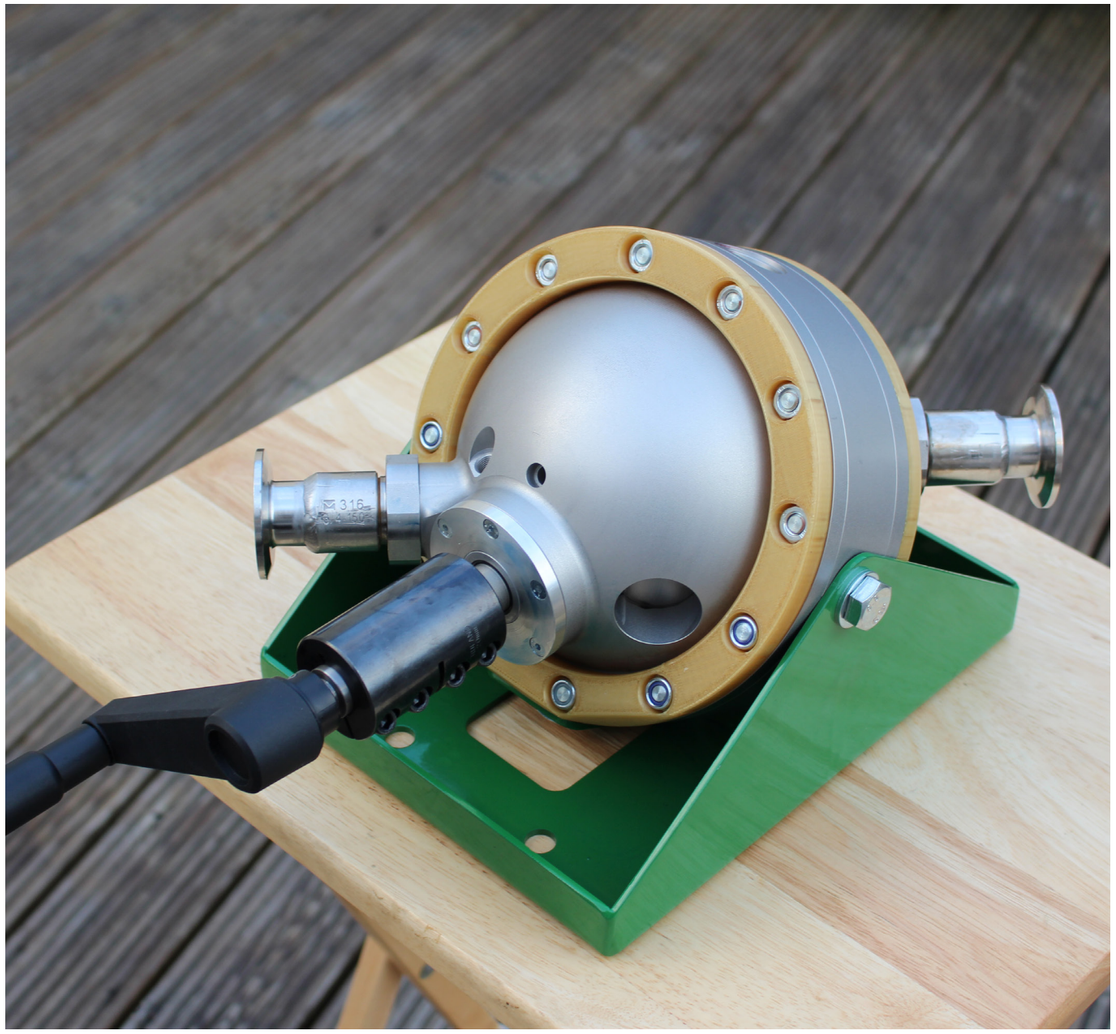
The FeTu™ Roticulating™ system is a new and entirely novel energy architecture targeting mass cross-sector decarbonisation. Combining the finest characteristics of radial, axial and reciprocal techniques into a single high-efficiency solution.

FeTu’s novel ‘Positive Displacement Turbine’ seamlessly and intrinsically translates between rotational and volumetric sources. The fundamental principle of all compressors, vacuum pumps, expanders and engines.

FeTu’s compressor achieved 7.2:1 pressure ratio at a speed of 1,500 revolutions per minute (RPM) (6.2barg), over 75% indicated efficiency, oil-free, and capable ofof generating 45 kilopascal (kPa) vacuum at only 50rpm. Unlike convention where one seems at the expense of the other, FeTu is both high-pressure and high-volume, and importantly is instantaneously effective from start-up. During test, FeTu was described as having the attributes of an ideal compressor. On the assumption of lossless porting and lossless sealing, FeTu can achieve 99.99% volumetric efficiency.

Able to produce high pressures at standard motor speeds, FeTu offers direct coupling without associated losses from speed correction (gearbox). Units are compact, inordinately light and low noise. FeTu’s combined characteristics are highly desirable and not currently available in a single offering; the potential to run oil free and +80% thermal efficiency offer a drastic step-change in a sector desperate for energy and net CO2 savings. FeTu have the potential to disrupt the entire compressor market by reducing CO2 output via higher energy efficiency and lower energy usage.

With 22 applications (including waste heat recovery, renewable power generation and natural refrigerant based cooling / heating) for the technology, FeTu could be the step-change innovation, the entire energy sector is looking for.



For the development of a step-change ‘Positive Displacement Turbine’, capable of transcending of how we create and use energy.

Business Start-Up Award

Geoptic
Infrastructure Investigations

Geoptic

The Company

Founded in 2019, Geoptic Infrastructure Investigations is a spin-out company from the Universities of Durham, Sheffield and St Mary's. Using patented technology that detects cosmic ray muons, the company specialises in non-invasive imaging of critical infrastructure, such as railway tunnels, to identify areas of concern such as hidden voids.

Geoptic has developed novel instrumentation and analysis tools that exploit naturally occurring cosmic ray muons to form images of otherwise hard-to-access objects. Using this so-called "muon radiography" technique, it has been successfully demonstrated that a scan data points along an object such as a railway tunnel is sufficient to yield valuable information regarding the overburden of the tunnel. In Geoptic's first successful application of the technique a disused railway tunnel in Alfreton was imaged. In addition to three clearly visible open shafts Geoptic also discovered a further, hidden shaft in the tunnel. A follow-up investigation which concentrated on imaging this hidden shaft was able to place strong constraints on the precise location, extent and effective depth of the hidden shaft. Subsequently Geoptic have been contracted to image further "live" (not disused) railway tunnels to perform checks on tunnel integrity and to search for hidden voiding.

The issue of hidden shafts and voiding, particularly within tunnels, is an ongoing, costly problem for the rail industry. Cosmic ray muon radiography allows for rapid surveys of potentially hazardous infrastructure, providing detailed, definitive and reliable data allowing clients to make a more-informed choice on maintenance and remediation. For example, the Alfreton tunnel had previously undergone repeated intrusive drilling into the crown with very mixed results. Intrusive drilling, usually upwards into the crown of a tunnel comes at great expense in machinery, personnel and time costs, and has inherent safety flaws caused by potential for collapse and water ingress, putting operatives at unnecessary risk. Geoptic's patented method therefore offers considerable cost and health and safety benefits.

For innovative contributions to the rail industry via the development of non-invasive imaging instrumentation and techniques, providing key infrastructure condition information, saving time and enhancing the safety of railway workers.

Business Start-Up Award

ORCA Computing

ORCA Computing

The Company

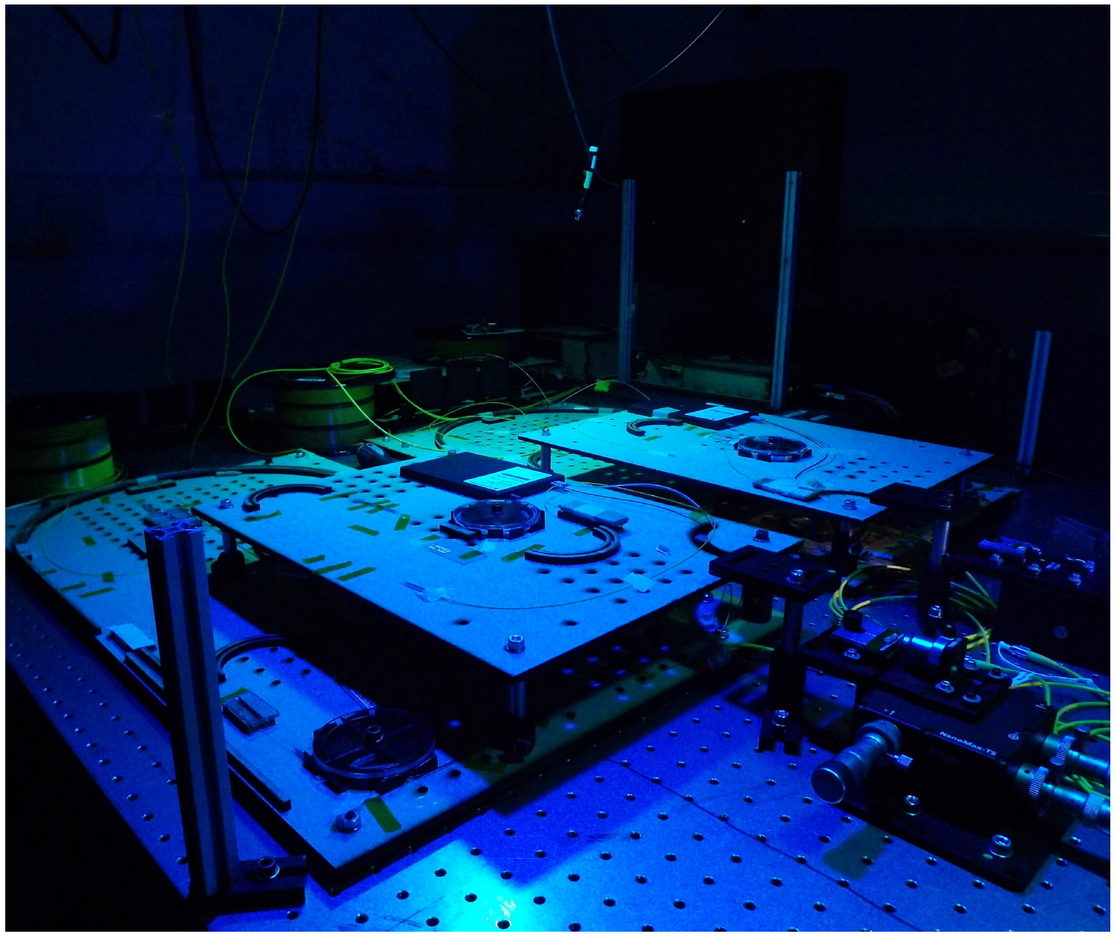
ORCA Computing is a UK company developing a completely new approach towards quantum computing. Our quantum memory allows storage and synchronisation of single and entangled photons, which enhances the prospects for future high-performance, highly connected and scalable quantum computing.

ORCA has developed a pioneering approach towards quantum computing, which will solve the scalability and connectivity challenges that the quantum computing hardware community is currently facing.

ORCA's quantum optical memory device allows broadband single photons and multiple entangled photon states to be stored and retrieved on demand within Rubidium gas. The memories' pioneering very low noise makes it suitable for storing quantum information, and ORCA has shown how this can be used within low-latency quantum networks and optical quantum processors.

Because ORCA's architecture relies on far fewer numbers of components, ORCA's approach is free to operate within optical fibre rather than the usual choice of silicon. This greatly reduces photon losses which currently challenge the scale-up of alternative photonic based quantum computing activities. Working in optical fibre also provides other benefits: allowing a greater degree of connectivity between qubits beyond a 2D nearest-neighbour, which will greatly enhance the computer's performance and tolerance towards photon losses and noise. Fibre is also a cheaper material to research and develop than silicon: no foundries are required and the visible light which is carried by fibre is easier and cheaper to detect.

The management team behind ORCA include world experts in the field of quantum optics, but also includes individuals with a strong business and industrial track-record. Together this multidisciplinary team will ensure that the company is well executed and financed, as well as delivers outstanding science and engineering-based products.



For pioneering a new, optical fibre-based method of quantum computing based on quantum memories and for building this into a scalable, internationally competitive business.

Business Start-Up Award

Oxford HighQ

The Company

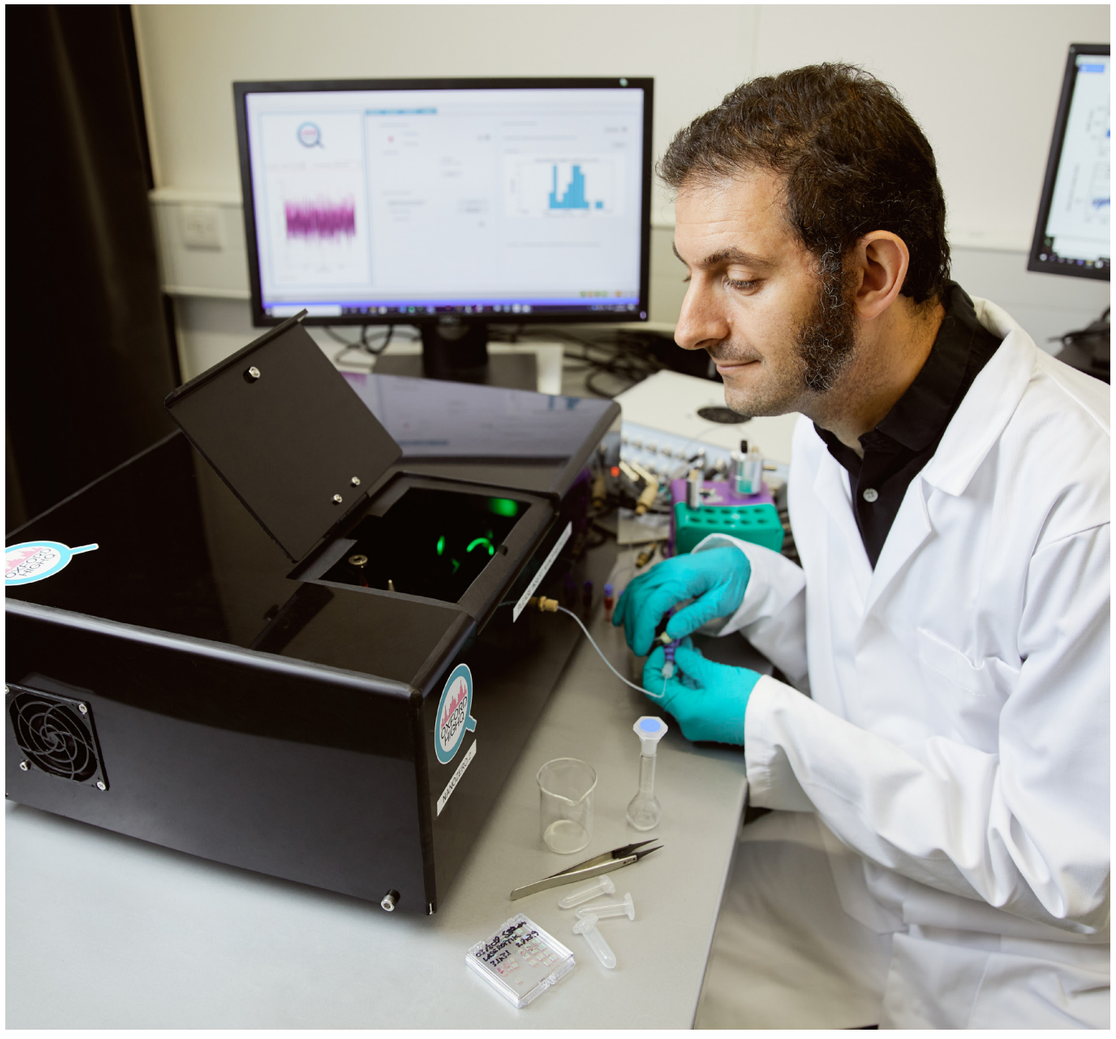
Oxford HighQ is a spin-out company, building on more than a decade of quantum technology research from the University of Oxford. The company is developing unique nanoparticle sensing instruments using micro-scale optical microcavities. The first product addresses a crucial application in nanomedicine to provide single particle measurement of drug loading.

A wide range of novel sensors and instrumentation are spinning out of quantum technology research, around core objectives in telecommunications and quantum computing. Oxford HighQ, a spin-out company from the University of Oxford, was formed to bring to market such spin-off technology called Optical Microcavity Analysis (OMCA) for application in nanoparticle and chemical sensing.

Optical microcavities amplify signals; these micrometre-sized devices provide a step change in sensor sensitivity and can operate with a sample of just a handful of molecules. Optical microcavity sensors for use with liquid samples will meet increasing demand for new tools in pharmaceutical and medical research, food and water monitoring and security and defence. High demand for compact systems that require smaller quantities of sample matches well with the properties of these remarkable and tiny devices. Furthermore, microcavity components are robust and inexpensive, and can be readily manufactured in volume.

The initial application chosen addresses crucial unmet needs in bringing new drugs to market, with particle-by-particle measurement of the quantity of active drug loaded into drug delivery nanoparticles. The nanomedicine market this technology will serve is estimated to be ~$80bn globally with a 22% CAGR. This invention unlocks barriers both to development and to regulation, by measuring the refractive index of nanoparticles in fluids, essentially looking inside particles at their chemical composition. Whilst this critical analysis can be achieved with a chain of extremely expensive and complex equipment, the optical microcavity solution is practical, robust and delivers results in real time at much lower cost: an ideal solution for on-line quality assurance in the manufacturing of advanced therapies.

This compelling narrative has led to substantive support from grant funding and private finance bodies, allowing the company to rapidly advance to delivering early demonstration models to potential users during the first half of 2020.



For the development of a novel characterisation solution to measure loading of drug delivery nanoparticles at single particle level, a key parameter for advanced therapies relying on nanocarriers.

Business Start-Up Award

OxMet Technologies

The Company

Founded in 2017 by Oxford University researchers, OxMet's mission is to develop, license and manufacture manufacture proprietary alloys, powders and components for the aerospace, automotive, industrial and biomedical markets. OxMet's ABD® alloys have a wide range of applications, making rockets, planes and cars more fuel efficient, and reducing medical implant problems.

OxMet Technologies develops proprietary alloys, alloy powders and alloy components for the aerospace, automotive, industrial and biomedical markets. Its alloys could make aeroplanes and cars more efficient, biomedical implants more compatible with the body, and consumer goods lighter and stronger. The Company has also tailored alloys for 3D printing, a new manufacturing platform which will transform industry over the coming decades. OxMet has already signed its first commercial licence, and will be commercialising its alloys and associated capabilities by a combination of licensing and manufacture.

The Company draws on technology and software developed over two decades by world-renowned researchers at Oxford University, in a research group which has been heavily industrially funded and is widely recognised as the world's leading research group in the area of the computational design of nickel superalloys.

Over the past 50 years, the physical and mathematical complexity of advanced alloys has made their development slow, empirical, and expensive – and therefore conservative. The Company's ABD® alloys-by-design technology combines physical models based on leading-edge scientific insight, proprietary software, and computational power to allow alloy design to be analytical, predictive and fast, reducing development time from years to months. On top of that, the Company's research team has industrially-tested expertise in the modelling of how alloys behave in manufacturing processes and the engineering design of alloy components which will allow it to leverage the value it derives from alloy compositions it patents.

For the development of new alloys with high temperature strength and crack free printability that outperform their existing counterparts using its proprietary software, reducing development time from years to months.

Business Start-Up Award

Photon Force

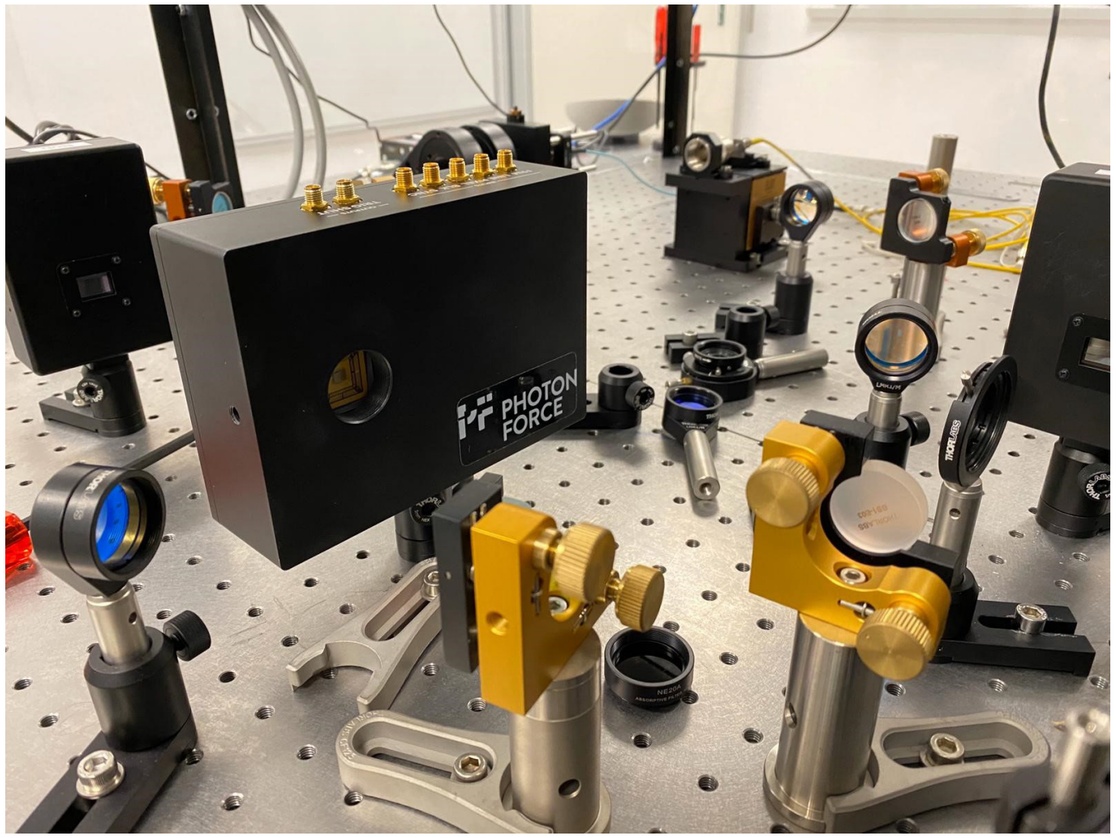
The Company

Photon Force designs and manufactures time-resolved single-photon-sensitive scientific cameras for application in areas spanning quantum physics, bio-medical imaging and communications. The business spun out of Robert Henderson's CMOS Sensors and Systems Group at the University of Edinburgh in 2015, and now employs a skilled team at its Edinburgh base.

Many applications require the detection and timing of individual photons, for example in LiDAR systems to measure distance, in quantum imaging to detect coincident photons, and in fluorescence lifetime measurements to infer information about a sample. However, established techniques involve discrete detectors and external single-channel timing electronics, able to process only one photon at a time. This system architecture is unfeasibly slow for many applications, while being bulky, fragile and cumbersome.

The PF32 was the world's first ultra-fast, single-photon sensitive, time-resolved camera product, brought to market by Photon Force in 2016. By shrinking the timing electronics to fit within each image sensor pixel, it offers an unparalleled throughput of 0.5B photons/s, the fastest TCSPC system available, with a time-resolution of tens of picoseconds. The cameras are powerful, versatile tools, providing a compact, robust, solid state-solution which is simple to use. This appeals to customers aiming to accelerate their single-photon imaging applications across science and industry, spanning quantum physics, communications, experimental LiDAR imaging, and biomedical modalities including fluorescence lifetime and imaging for neuroscience.

Having developed the technology from a research prototype to a commercial product line, Photon Force is now scaling up production to support increased sales volumes from our growing geographical presence, as well as offering greater breadth of application support. We are continuing to develop the PF32 camera family, introducing variants offering 15x improved sensitivity and 10x reduced noise, delivering a further step change in performance. Photon Force is also developing new sensor architectures offering vastly enhanced throughput, with the potential to further disrupt the quantum sensing market, and engaging with industrial OEM customers to develop future integrated devices.



For developing ground-breaking sensors enabling ultrafast single-photon-sensitive imaging, facilitating progress in applications including quantum physics, communications, and neuroscience.

QLM Technology

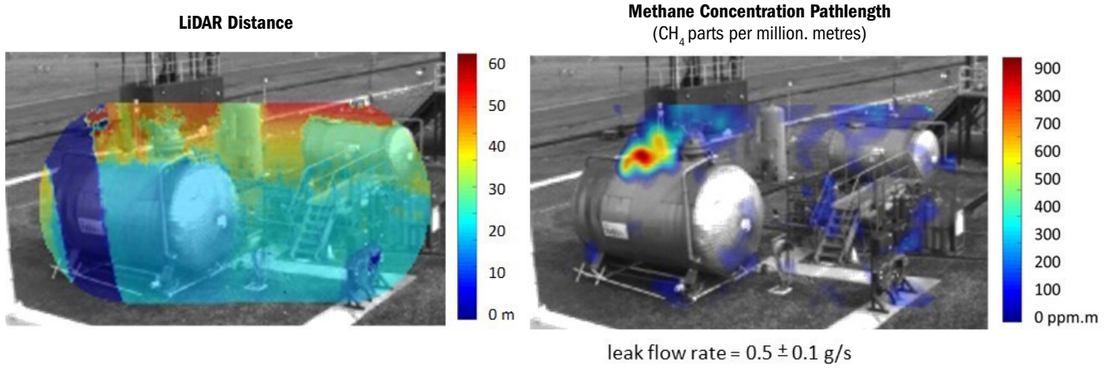
The Company

Founded at the Quantum Technology Enterprise Centre at the University of Bristol, QLM is developing innovative low-power tuneable diode LiDAR gas imaging systems based on infrared single-photon detection. QLM aims to produce a low-cost platform of gas imagers that enable continuous and fully automatic greenhouse gas emission monitoring to help natural gas producers, distributors, service providers and environmental agencies limit climate change.

Fugitive natural gas emissions are a major source of greenhouse gases that could be rapidly reduced if they were detected. But existing detection technologies are expensive and require trained operators, so inspections remain intermittent and incomplete, and large leak ‘super emitters’ dominate emissions. QLM is a start-up in Bristol developing innovative gas leak cameras to meet this need. Our tuneable diode LiDAR imagers are based on mature telecommunication technology and innovative high-speed infrared single-photon detectors. Our practical, compact, wide-area, low-power imagers provide long range (>100m), accurate and continuous gas imaging and leak measurement in industrial environments over a wide range of conditions.

We are actively engaged with the National Physical Laboratory emissions metrology group and multiple natural gas service and equipment developers and end users on advancing and integrating our designs and algorithms into rugged gas leak ‘security cameras’ capable of continuously monitoring methane, the main constituent of natural gas and the second biggest global greenhouse gas, and other gases such as carbon dioxide, ethylene and carbon monoxide.

Business Start-Up Award



For the development of long-range gas leak imaging systems based on semiconductor lasers and infrared single-photon detection, to provide low cost detection of fugitive greenhouse gas emissions for industrial and environmental applications.

Nine years of Business Award winners

Winners

Active Needle Technology

Advanced Hall Sensors

Aeristech

Airbus Defence and Space

Aqua Cooling Solutions

Aurox

Causeway Sensors

Cellular Highways

Coherent Scotland

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Elekta

Endomag

FeTu

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Geoptic

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Hallmarq Veterinary Imaging

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Innovative Physics

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MR Solutions

Naneum

Nebu~Flow

Novosound

Opsydia

ORCA Computing

Ossila

ONI

Oxford HighQ

Oxford Space Systems

OxMet Technologies

PepsiCo

Photon Force

Plastipack

Promethean Particles

pureLiFi

QLM Technology

Reaction Engines

Rolls-Royce

Silixa

Simpleware

Sonobex

Stream Bio

Teledyne e2v

Tesla Engineering

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